CLAIM AMENDMENTS

Please amend claims 1, 8, 14, and 22 as follows.

1. (Currently Amended) An apparatus, comprising:

a buried tapered waveguide disposed in a semiconductor layer; and

a tapered rib waveguide disposed in the semiconductor layer proximate to the buried tapered waveguide, the tapered rib waveguide including a rib portion adjoining a slab portion, the slab portion of the rib waveguide adjoining the buried tapered waveguide, <u>the buried tapered waveguide being beneath the slab portion of the tapered rib waveguide,</u> wherein an optical beam is directed into a larger end of the buried tapered waveguide and the tapered rib waveguide, the buried tapered waveguide tapered to guide the optical beam therethrough into the slab portion of the rib waveguide, wherein a vertical height of the buried tapered waveguide at the larger end and at a smaller end opposite the larger end are substantially similar.

2. (Original) The apparatus of claim 1 further comprising an insulator disposed in the semiconductor layer, the insulator surrounding and serving as cladding for the buried tapered waveguide to provide vertical and lateral optical confinement in the buried tapered waveguide.

3. (Previously Presented) The apparatus of claim 2 wherein the smaller end of the buried tapered waveguide opposite the larger end of the buried tapered waveguide is defined by the insulator disposed in the semiconductor layer.

4. (Original) The apparatus of claim3 wherein the insulator comprises oxide grown in a tapered trench etched from the semiconductor layer.

5. (Original) The apparatus of claim 3 wherein the buried tapered waveguide and the tapered rib waveguide comprise epitaxial lateral overgrowth (ELO) silicon defined within the oxide.

6. (Previously Presented) The apparatus of claim 1 wherein the buried tapered waveguide includes a first and second lateral taper regions, the first lateral taper region tapering at a first lateral taper rate from the larger end of the buried tapered waveguide to the second lateral taper region of the buried tapered waveguide, the second lateral taper region tapering at a second lateral taper rate from the first lateral taper region of the buried tapered waveguide to the smaller end of the buried tapered waveguide, wherein the first lateral taper rate is greater than the second lateral taper rate.

7. (Previously Presented) The apparatus of claim 1 wherein the tapered rib waveguide includes a first and second lateral taper regions, the first lateral taper region tapering at a third taper rate from the larger end of the tapered rib waveguide to the second lateral taper region of the tapered rib waveguide, the second lateral taper region tapering at a fourth lateral taper rate from the first lateral taper region of the tapered rib waveguide to [[a]] the smaller end of the tapered rib waveguide, wherein the third lateral taper rate is greater than the fourth lateral taper rate.

8. (Currently Amended) A method, comprising:

directing an optical beam into a larger end of a buried tapered waveguide and a tapered rib waveguide disposed in a semiconductor layer, the tapered rib waveguide including a rib portion adjoining a slab portion, the slab portion of the rib waveguide adjoining the buried tapered waveguide;

directing a mode of the optical beam propagating through the buried tapered waveguide into the slab portion of the rib waveguide adjoining the buried tapered waveguide, the buried tapered waveguide being beneath the slab portion of the tapered rib waveguide; and

outputting substantially all of the optical beam directed into the larger end of the buried tapered waveguide and the tapered rib waveguide from a smaller end of the tapered rib waveguide, the smaller end of the tapered rib waveguide opposite the larger end of the tapered rib waveguide, wherein a vertical height of the buried tapered waveguide at the larger end and at the smaller end are substantially similar.

9. (Original) The method of claim 8 further comprising shrinking a mode size of the optical beam from a larger mode size when directed into the larger end of the buried tapered waveguide and the tapered rib waveguide to a smaller mode size when output from the smaller end of the tapered rib waveguide.

10. (Previously Presented) The method of claim 9 wherein shrinking the mode size of the optical beam comprises:

shrinking the mode size of the optical beam at a first lateral taper rate when the optical beam is directed into the larger end of the buried tapered waveguide and the tapered rib waveguide; and

shrinking the mode size of the optical beam at a second lateral taper rate when directing the mode of the optical beam propagating through the buried tapered waveguide into the slab portion of the rib waveguide adjoining the buried tapered waveguide.

11. (Previously Presented) The method of claim 10 wherein the first lateral taper rate is greater than the second lateral taper rate.

12. (Original) The method of claim 8 wherein directing the optical beam into the larger end of the buried tapered waveguide and the tapered rib waveguide includes directing the optical beam from an optical fiber.

13. (Original) The method of claim 8 further comprising directing the optical beam from the smaller end of the tapered rib waveguide into a semiconductor photonic device disposed in the semiconductor layer.

14. (Currently Amended) A method, comprising:

etching a first semiconductor layer of a silicon-on-insulator (SOI) wafer with a first mask;

etching a buried taper opening into a second semiconductor layer of the SOI wafer with a buried taper mask, the buried taper mask having a larger end and a smaller end,

wherein a vertical height of the buried tapered opening at the larger end and at the smaller end are substantially similar;

growing an insulating layer in the buried taper opening;

growing silicon in and over the buried taper opening over the insulator layer to form a buried tapered waveguide; and

patterning a tapered rib waveguide in the silicon grown over the buried tapered waveguide using a tapered rib waveguide mask such that a slab portion of the tapered rib waveguide adjoins the buried tapered waveguide, <u>the buried tapered waveguide is beneath the slab portion of the tapered rib waveguide,</u> the tapered rib waveguide having a larger end and a smaller end corresponding to the larger and smaller ends, respectively, of the buried tapered waveguide.

15. (Original) The method of claim 14 further comprising sharpening a tip of the buried tapered waveguide defined at the smaller end of the buried taper opening by growing the insulating layer in the buried taper opening.

16. (Previously Presented) The method of claim 14 wherein etching the buried taper opening into the second semiconductor layer of the SOI wafer with the buried taper mask includes defining first and second lateral taper regions in the buried tapered waveguide, the first lateral taper region of the buried tapered waveguide to taper at a first lateral taper rate from the larger end of the buried tapered waveguide to the second lateral taper region of the buried tapered waveguide, the second lateral taper region of the buried tapered waveguide to taper at a second lateral taper rate from the first lateral taper region of the buried tapered waveguide to the smaller end of the buried tapered waveguide.

17. (Previously Presented) The method of claim 16 wherein the first lateral taper rate is greater than the second lateral taper rate.

18. (Previously Presented) The method of claim 14 wherein patterning the tapered rib waveguide in the silicon grown over the buried tapered waveguide using the tapered rib waveguide mask includes defining first and second lateral taper regions in the tapered rib

waveguide, the first lateral taper region of the tapered rib waveguide to taper at a third lateral taper rate from the larger end of the tapered rib waveguide to the second lateral taper region of the tapered rib waveguide, the second lateral taper region of the tapered rib waveguide to taper at a fourth lateral taper rate from the first lateral taper region of the tapered rib waveguide to the smaller end of the tapered rib waveguide.

19. (Previously Presented) The method of claim 18 wherein the third lateral taper rate greater than the fourth lateral taper rate.

20. (Original) The method of claim 14 further comprising optically coupling an optical fiber to the larger ends of the buried tapered waveguide and the tapered rib waveguide.

21. (Original) The method of claim 14 further comprising optically coupling a photonic device disposed in the SOI wafer to the smaller end of the tapered rib waveguide.

22. (Currently Amended) A system, comprising:

an optical transmitter to transmit an optical beam;

an optical receiver; and

an optical device disposed between the optical transmitter and the optical receiver, the optical device including:

a buried tapered waveguide disposed in a semiconductor layer;

a tapered rib waveguide disposed in the semiconductor layer proximate to the buried tapered waveguide, the tapered rib waveguide including a rib portion adjoining a slab portion, the slab portion of the rib waveguide adjoining the buried tapered waveguide, <u>the buried tapered waveguide being beneath the slab portion of the tapered rib waveguide,</u> wherein an optical beam is directed into a larger end of the buried tapered waveguide and the tapered rib waveguide, the buried tapered waveguide tapered to guide the optical beam therethrough into the slab portion of the rib waveguide, wherein a vertical height of the buried tapered waveguide at the larger end and at a smaller end opposite the larger end are substantially similar; and

a photonic device disposed in the semiconductor layer optically coupled to the smaller end of the tapered rib waveguide,

the optical beam optically coupled to be received from the optical transmitter by the buried tapered waveguide and the tapered rib waveguide, the optical beam to be directed from the tapered rib waveguide through the photonic device to the optical receiver.

23. (Original) The system of claim 22 further comprising an optical fiber optically coupled between the optical transmitter and the buried tapered waveguide and the tapered rib waveguide.

24. (Original) The system of claim 22 wherein the optical device further comprises an insulator disposed in the semiconductor layer, the insulator surrounding and serving as cladding for the buried tapered waveguide to provide vertical and lateral optical confinement in the buried tapered waveguide.

25. (Previously Presented) The system of claim 24 wherein the smaller end of the buried tapered waveguide opposite the larger end of the buried tapered waveguide is defined by the insulator disposed in the semiconductor layer.

26. (Previously Presented) The system of claim 22 wherein the buried tapered waveguide includes a first and second lateral taper regions, the first lateral taper region tapering at a first lateral taper rate from the larger end of the buried tapered waveguide to the second lateral taper region of the buried tapered waveguide, the second lateral taper region tapering at a second lateral taper rate from the first lateral taper region of the buried tapered waveguide to the smaller end of the buried tapered waveguide, wherein the first lateral taper rate is greater than the second lateral taper rate.

27. (Previously Presented) The system of claim 22 wherein the tapered rib waveguide includes a first and second lateral taper regions, the first lateral taper region tapering at a third lateral taper rate from the larger end of the tapered rib waveguide to the second lateral taper region of the tapered rib waveguide, the second lateral taper region tapering at a fourth lateral taper rate from the first lateral taper region of the tapered rib waveguide to the smaller end of the tapered rib waveguide, wherein the third lateral taper rate is greater than the fourth lateral taper rate.